N5 Analogue Electronics



Combined resistance calculations (a)

Start these questions by solving the total resistance of the parallel branch. We then treat the parallel branch as a single resistance to calculate the total circuit re-



(b)

Calculate the resistance of the 3 LEDs in parallel.

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$
$$\frac{1}{R_P} = \frac{1}{82} + \frac{1}{78} + \frac{1}{86}$$
$$\frac{1}{R_P} = 0.03664$$
$$\frac{R_P}{1} = \frac{1}{0.03664}$$
$$\frac{R_P}{R_P} = 27\Omega$$

Calculate the total resistance of the circuit.

$$R_T = R_1 + R_P$$
$$R_T = 390 + 27$$

 $R_T = 417\Omega$



LDR Graph

The LDR graph can be tricky to read. Pay close attention to the values at 1 or 10 to make sure you know whether it's 1s, 10s, 100s or 1000s that you are working with. Remember that the resistance is measured in $k\Omega$.



Thermistor Graph

The Thermistor graph also jumps up in large increments on the resistance scale. Be careful to follow the correct thermistor type line to work out your value.



Voltage Divider Calculations

A voltage divider is a series circuit.

Voltages across the two components added together equal the supply voltage. The current is the same through both components.

To find the total resistance, add the resistances of both components together.

Calculate the resistance of the thermistor. (a)

Step 1 - we know a voltage and a resistance from the bottom part of the circuit so we can calculate current.

Step 2 - We can now work out the voltage across the thermistor by knowing that the total voltage is the voltage across both components added together.

Step 3 - now we can use Ohm's law again to calculate the resistance of the thermistor using the voltage across the thermistor and the current that stays the same.

 $V = I \times R$ -t° $1.9 = I \times 1700$ 1.9 = I1700 I = 1.1mA $V_{S} = V_{1} + V_{2}$ 1.7 kΩ 1.9 V $5 = V_1 + 1.9$ $5 - 1.9 = V_1$ OV O- $V_1 = 3.1V$

 $V = I \times R$

= R

 $R = 2818\Omega$

3.1

 (1.1×10^3)

 $3.1 = (1.1 \times 10^3) \times R$

5.0 V O-

booklet.

The input sensing circuit (which is part of the warning circuit) is shown below.



(c) Calculate the resistance of the thermistor

Step 1 - we know both voltages and one resistance so we can use the formula from the data

$$\frac{\frac{1}{V_2} = \frac{R_1}{R_2}}{\frac{0.84}{5.2} = \frac{R_1}{190}}$$
$$0.161 \times 190 = R_1$$
$$R_1 = 31K\Omega$$

 V_{1} R.

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